PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Yukihito ICHIKAWA et al.

Application No. New U.S. National Stage of PCT/JP03/03858

Filed: September 23, 2004 Docket No.: 121234

For: CELL STRUCTURAL BODY, METHOD OF MANUFACTURING CELL STRUCTURAL BODY, AND CATALYST STRUCTURAL BODY

TRANSLATION OF THE AMENDMENTS
UNDER PCT ARTICLE 19 (35 USC 371(c)(3))

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Attached hereto is a translation of the amendments of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)). The attached translated material replaces the claims.

Respectfully submitted,

James A. Oliff
Registration No. 27,075

Joel S. Armstrong
Registration No. 36,430

JAO:JSA/emt

Date: September 23, 2004

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461

Brief Statement under Article 19(1) of Treaty

The limitations of claims 2 and 3 were added to claim 1.

In view of the above amendments, claims 2 and 3 were deleted, and claims 2 and 3 were deleted from the claims cited in claims 4, 5, 7-21 and 26. Furthermore, claim 6 was rewritten as an independent claim.

The limitation of claim 23 was added to claim 22.

In view of the above amendment, claim 23 was deleted.

Claims 24, 25, and 27-31 were as originally filed and no amendments were made to these claims.

Replaced by Am'd Art (19).

Claims

1. A cell structure which is a cylindrical cell structure comprising a plurality of cells which pierce through the structure between two end faces and are flow paths for fluid, an outer wall which encloses the cells and a cavity which pierces in the direction of a central axis of the structure through a portion including the central axis or a given axis parallel to the central axis, where the cell structure further has an inner wall on an inner surface of the cavity.

2. A cell structure according to claim 1, wherein the cells are partitioned in the form of a honeycomb with partition walls.

3. A cell structure according to claim 2, wherein a strength index represented by formula:

strength index = $(T/CP)^2 \times (B/A)^2$

is not less than 0.02 in which T denotes a thickness (mm) of the partition wall, CP denotes a cell pitch (mm), A denotes a length (mm) of a line formed by linking, along the outer wall, points of intersection of an outer wall with two tangent lines which contact with inner contour of the inner wall and extend in parallel in longitudinal direction of the partition wall, and B denotes a distance (mm) between a point of contact of the tangent line with the inner contour of the inner wall and a point of intersection of the tangent line with a closest outer wall at the section formed by cutting the cell structure along a plane perpendicular to the central axis of the cell structure.

4. A cell structure according to claim 3, wherein the

strength index is not less than 0.04.

5. A cell structure according to any one of claims 2-4, wherein the cell structure has a plurality of cavities and a plurality of the cavities is disposed so as to give a value of B/A larger than maximum value of B/A of a cell structure having one cavity of a volume equal to the total volume of a plurality of cavities.

6. A cell structure according to claim 1 which is a foam structure wherein the cells communicate three-dimensionally with each other through intercellular walls.

7. A cell structure according to any one of claims 1-6, wherein the thickness of the inner wall is not less than 1% of a representative radius of the cavity.

8. A cell structure according to any one of claims 1-7, wherein in case of a section formed by cutting the cell along a plane perpendicular to the central axis being tetragonal or hexagonal, a ratio (d/D) of a representative inner diameter (d) to a representative outer diameter (D) of the honeycomb structure or foam structure is not more than 0.5, and in the case of a section formed by cutting the cell along a plane perpendicular to the central axis being triangle or wavy, a ratio (d/D) of a representative inner diameter (d) to a representative outer diameter (D) of the honeycomb structure or foam structure is not more than 0.8.

9. A cell structure according to any one of claims 2-8, wherein among the partition walls or intercellular walls, the thickness of a partition wall (a first or second reinforcing partition wall) or an intercellular wall (first intercellular

wall) positioned at a given distance from an inner wall in diameter direction is larger than the thickness of other partition walls (ordinary partition walls) or intercellular walls (ordinary intercellular walls).

10. A cell structure according to any one of claims 2-9, wherein in the case of the section formed by cutting the cell along a plane perpendicular to the central axis being tetragonal, among the partition walls or intercellular walls, the thickness of at least one partition wall (a third or fourth reinforcing partition wall) or at least one intercellular wall (a third or fourth reinforcing intercellular wall), the tip of which contacts with an inner wall, which contacts with the inner wall or which is externally apart from the inner wall is larger than the thickness of other partition walls (ordinary partition wall) or intercellular walls (ordinary intercellular walls).

11. A cell structure according to any one of claims 2-10, wherein among the cells, the cell density of a given number of cells (first or second reinforcing cells) positioned at a given distance from the inner wall in diameter direction is higher than the cell density of the cells (ordinary cells) other than the first or second reinforcing cells.

12. A cell structure according to any one of claims 2-11, wherein among the cells, a given number of cells (third reinforcing cells) positioned at a given distance from the central axis in diameter direction is partitioned with at least one partition wall (fifth reinforcing partition wall) or intercellular wall (fifth reinforcing intercellular wall) which divides the inside of the cells.

13. A cell structure according to any one of claims 2-12, wherein a partition wall (sixth reinforcing partition wall) or intercellular wall (sixth reinforcing intercellular wall) which contact with an inner wall has thick wall portions formed at the contact portions.

14. A cell structure according to any one of claims 2-13, wherein among the cells, a given number of cells (fourth reinforcing cells) positioned at a given distance from the inner wall in diameter direction is filled in their cell passages with a material for filling cells.

15. A cell structure according to any one of claims 2-14, wherein among the partition walls or intercellular walls, partition wall (seventh reinforcing partition wall) or intercellular wall (seventh reinforcing intercellular wall) positioned at a given distance from the inner wall in diameter direction is more densified than other partition walls (ordinary partition walls) or intercellular walls (ordinary intercellular walls).

16. A cell structure according to any one of claims 2-15, wherein the partition walls or intercellular walls comprise a partition wall (eighth reinforcing partition wall) concentric with an inner wall and a partition wall (ninth reinforcing partition wall) radial from the central axis, or an intercellular wall (eighth reinforcing intercellular wall) concentric with an inner wall and intercellular wall (ninth reinforcing intercellular wall) radial from the central axis.

17. A cell structure according to any one of claims 2-15, wherein the partition walls or intercellular walls comprise

partition wall (tenth reinforcing partition wall) concentric with an inner wall and wavy partition wall (eleventh reinforcing partition wall), or intercellular wall (tenth reinforcing intercellular wall) concentric with the inner wall and wavy intercellular wall (eleventh reinforcing intercellular wall).

18. A cell structure according to any one of claims 2-15, wherein the partition walls or intercellular walls comprise partition wall (twelfth reinforcing partition wall) concentric with the inner wall and corrugated partition wall (thirteenth reinforcing partition wall), or intercellular walls (twelfth reinforcing intercellular wall) concentric with the inner wall and corrugated intercellular wall (thirteenth reinforcing intercellular wall).

19. A cell structure according to any one of claims 2-18, wherein the honeycomb structure or the foam structure comprises at least one component selected from the group consisting of the following component (a), component (b), component (c) and component (d):

(a): ceramic materials containing at least one compound selected from the group consisting of cordierite, alumina, mullite, lithium aluminum silicate, aluminum titanate, titania, zirconia, silicon nitride, aluminum nitride, silicon carbide, calcium silicate, zirconium phosphate, zirconyl phosphate, ceria, yttria and magnesia,

(b): ceramic materials containing composites of the compounds shown in (a),

(c): heat resistant metals,

(d): adsorptive materials containing at least one selected from the group consisting of active carbon, silica gel and zeolite.

20. A cell structure according to any one of claims 2-19, wherein the inner wall comprises a material higher in mechanical strength than the partition wall or the intercellular wall.

21. A cell structure according to any one of claims 2-20, wherein a reinforcing material concentric with the inner wall is provided on the inner surface side of the inner wall, and a cushioning member having compressibility and elasticity is provided between the inner surface of the inner wall and the reinforcing material.

22. A method for producing a cell structure which comprises extruding a ceramic material from a die having a plurality of grooves formed in the form of slit and firing the extruded product to produce a cell structure having a plurality of cells partitioned with partition walls, characterized in that the ceramic material is extruded from the grooves formed in the form of slit of the die in such a state that a press platen having a given shape for the formation of an inner wall is provided above the central portion of an end face of the die, said end face being the side from which the ceramic material is extruded, and the resulting extruded product is fired, thereby to produce a cell structure having a plurality of cells, a cavity which pierces the portion including the central axis or a given axis parallel to the central axis in the direction of the central axis, and an inner wall on the inner surface of

the cavity.

23. A method for producing a cell structure according to claim 22, wherein a guide for uniformly flowing the ceramic material is provided underneath the press platen for the formation of the inner wall on the side of the die into which the ceramic material is introduced.

24. A method for producing a cell structure which comprises extruding a ceramic material from a die having a plurality of grooves formed in the form of slit and firing the extruded product to produce a cell structure having a plurality of cells partitioned with partition walls, characterized in that the ceramic material is extruded from the grooves formed in the form of slit in such a state of masking the grooves formed in the form of slit positioned above the central portion of the end face of the die, said end face is the side from which the ceramic material is extruded, and the resulting extruded product is fired, thereby to produce a first cell structure having a cavity at which the partition walls are bared and, furthermore, a given coating material is coated on the inner surface of the cavity of the resulting first cell structure to form an inner wall, thereby to produce a second cell structure having a plurality of the cells, the cavity which pierces the portion including the central axis or a given axis parallel to the central axis in the direction of the central axis, and the inner wall on the inner surface of the cavity.

25. A method for producing a cell structure which comprises extruding a ceramic material from a die having a plurality of grooves formed in the form of slit and firing the

extruded product to produce a cell structure having a plurality of cells partitioned with partition walls, characterized in that the ceramic material is extruded from the die and the resulting extruded product is fired, thereby to obtain a third cell structure having a plurality of cells partitioned with the partition walls, and the cells of the third cell structure which are positioned at a given distance from the central axis in diameter direction among a plurality of the cells are bored in the direction of central axis to form a cavity, thereby to obtain a fourth cell structure and simultaneously an inner wall is formed on the inner surface of the cavity of the fourth cell structure.

26. A catalyst structure, characterized in that a catalyst component for purification of exhaust gas and/or a adsorptive component are supported on the surface of the partition walls or intercellular walls constituting the cell structure of any one of claims 2-21 and/or on the surface of inside pores of the cell structure.

27. A catalyst structure according to claim 26, wherein both ends of the cells are alternately sealed so that a fluid passing through the cells as flow paths is passed through the inside of the partition walls or intercellular walls.

28. A catalyst structure according to claim 26, wherein the adsorptive component is mainly composed of zeolite.

29. An adsorption apparatus, characterized in that the catalyst structure of any one of claims 26-28 is provided in the flow path of a fluid containing components to be adsorbed.

30. A fuel reforming apparatus, characterized in that

the catalyst structure of any one of claims 26-28 is provided in the flow path of raw material gas and/or gas to be reformed.

31. A heat recovery apparatus, characterized in that the catalyst structure of any one of claims 26-28 is provided therein as a heat storage material.